

New Early Cretaceous hymenopterous insects (Insecta: Hymenoptera) from Sierra del Montsec (Spain)

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With 4 figures

Kurzfassung: Aus den unterkretazischen Plattenkalken (Unter-Barrême) der Sierra del Montsec (Provinz Lérida, NE-Spanien) werden vier neue Hymenopteren-Arten beschrieben: *Prosyntexis montsecensis* n. sp. (Sepulcidae), *Manlaya lacabrua* n. sp. (Gasteruptiidae), *Meiagaster cretaceus* n. gen., n. sp. (Bethylonymidae), *Angarosphex lithographicus* n. sp. (Sphecidae). Die Funde aus Spanien repräsentieren eine weitere umfangreiche unterkretazische Hymenopterenfauna, sie erweitern die Kenntnis der geographischen Verbreitung dieser Ordnung beträchtlich und lassen sich gut mit einem trockenen Klima mit saisonalen Regenfällen in Einklang bringen.

Abstract: Four new species of Hymenoptera are described from the Early Cretaceous (Lower Barremian) lithographic limestones of the Sierra del Montsec (Lérida Province, NE Spain): *Prosyntexis montsecensis* n. sp. (Sepulcidae), *Manlaya lacabrua* n. sp. (Gasteruptiidae), *Meiagaster cretaceus* n. gen., n. sp. (Bethylonymidae), *Angarosphex lithographicus* n. sp. (Sphecidae). The Spanish assemblage extends our knowledge of the distribution of the Lower Cretaceous hymenopteran fauna and will throw light on its character in a probably dry environment with seasonal rainfall.

Introduction

The hymenopterous insects (Order Hymenoptera/Vespida) from the lithographic limestones of Sierra del Montsec are of great potential importance for improving understanding of both the history of this insect group and the palaeoenvironments of NE Spain in the mid Lower Cretaceous. Over the last few decades a considerable amount of information has accumulated about Lower Cretaceous hymenopterans from various parts of the world: Central and Eastern Asia (RASNITSYN 1969, 1980, 1986, 1988, 1990, 1991a, b, 1993a, b; HONG 1983, 1988; HONG & WANG 1990; RASNITSYN & SHARKEY 1988; REN et al. 1995; ZHANG 1992, and others), England (RASNITSYN et al. 1998), Australia (JELL & DUNCAN 1986) and Brazil (DARLING & SHARKEY 1990). Basic features of these fossil assemblages have been outlined, including

their composition, regional differences and possible stratigraphic and paleoenvironmental implications (RASNITSYN et al. 1998). The hymenopteran fauna of the lithographic limestones of Sierra del Montsec has been less well studied to date. Although a hymenopteran fossil was recorded almost a century ago (MEUNIER 1903), it was 90 years before a second species was described (ANSORGE 1993b). Some specimens were figured by WHALLEY & JARZEMBOWSKI (1985: figs. 26, 27), GOMEZ-PALLEROLA (1986: figs. 35, 36) and MARTINEZ-DELCLOS (1991: pl. 16, fig. c), but without systematic descriptions. Fortunately, nearly two dozen Montsec hymenopteran fossils deposited in recent years in three European museums (Departamento de Geología Dinámica, Geofísica y Paleontología, Universitat Central, Barcelona; Muséum National d'Histoire Naturelle, Paris; Institut für Geologische Wissenschaften der Ernst-Moritz-Arndt-Universität, Greifswald) became available for study by the senior author with collaborators. Among this material were specimens collected by the junior author from the Sierra del Montsec, which are described below.

Age and geological setting

The hymenopterans described in this paper were collected at 'La Cabrua' outcrop – a locality situated along a steep local road in the mountain range Montsec de Rubies (Sierra del Montsec, Lérida Province, NE Spain, 42° 0' N, 0° 57' E) (ANSORGE 1991, 1993b; MARTINEZ-DELCLOS 1991, 1995).

The carbonate sediment which makes up the lithographic limestones of the Sierra del Montsec (particle size about 3 µm) was deposited in the deepest parts of a fresh or brackish-water lagoon lacking direct connections to the epicontinental sea. Charophyte limestones were deposited in shallower water.

Originally an Upper Berriasian – Lower Valanginian age was proposed for the lithographic limestones on the

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basis of the freshwater ostracod fauna (BRENNER et al. 1974). However, after recording utricles of the charophyte *Atopochara trivolvis triquetra* GRAMBAST 1968 (morphotype 'typique'), ANSORGE (1991, 1993a) suggested a Lower Barremian age, which has been supported by MARTÍN-CLOSAS & LÓPEZ-MÓRON (1995).

The rich and well preserved insect fauna of Montsec consists of autochthonous/parautochthonous aquatic insect larvae and allochthonous terrestrial insects. The following insect orders have been recorded to date: Ephemeroptera, Odonata, Blattodea, Saltatoria, Coleorrhyncha, Heteroptera, Homoptera, Psocoptera, Trichoptera, Neuroptera, Raphidiodea, Diptera, Hymenoptera and Coleoptera. The most common fossil insect is the aquatic larva of the mayfly *Mesopalinega leridae* WHALLEY & JARZEMBOWSKI 1985. Among terrestrial flying insects Blattodea and Coleoptera are most common, although hymenopterans are not particularly rare. Along with the plant macrofossils (BARALE 1995) the insects indicate a dry climate with seasonal rainfall.

Systematic Description

Family Sepulcidae RASNITSYN 1968

Subfamily Trematothoracinae RASNITSYN 1988

Genus Prosyntexis SHARKEY 1990

Prosyntexis montsecensis n. sp.

Fig. 1

1991 Ephialtitidae gen. et sp. indet. – ANSORGE: 60, pl. 7, fig. 1.

Derivatio nominis: species named after the Montsec Range in Spain.

Holotype: incomplete female, housed in Institut für Geologische Wissenschaften of Ernst-Moritz-Arndt-Universität Greifswald, FGWG 147 (MA 6).

Diagnosis: The new species clearly differs from the three other species in the genus: the type *P. gouleti* SHARKEY 1990 from the Aptian of Brazil, *P. gobiensis* (RASNITSYN 1993) from the Barremian or Aptian of Mongolia, and *P. okhotensis* (RASNITSYN 1993) from the Cenomanian of East Siberia, in having a narrow pterostigma with subapical 2r-rs and a longer cell 2r. It also differs, at least from *P. gouleti* and *P. okhotensis*, in having a very long, narrow ovipositor.

Description: Male unknown. Female: ground colour moderately dark, with lighter scape, pedicell, flagellar apex and legs (except fore femur). Flagellum thin and long, with about 20 segments; flagellomeres subhomonomous and elongate, becoming gradually shorter and very slightly thinner towards the apex. Head large, cubical, with large temples and irregularly subisometrical eyes. Pronotum long medially; mesonotum reticulate-rugose laterally, membranous medially, otherwise thoracic morphology obscure. Forewing with costal space moderately narrow, narrower toward the very base; pterostigma narrow, with 2r-rs near its apex; R complete

within 3r cell; 2r cell more than twice as long as wide; 2r-m lost; 2+3rm cell short, with 2r-rs at its middle and 2m-cu at its distal quarter; 3r-m more distant from 3r cell apex than from 2r-rs; M+Cu with distinct basal arching. Legs thin and relatively short. Ninth tergum with vertical rugosity laterally. Ovipositor longer than thorax and abdomen combined, with a segmented appearance. Length of body 12.9 mm, of forewing up to 3r cell apex 6.0 mm, of ovipositor sheath, as preserved, 8.5 mm.

Remarks: The holotype fossil is incomplete, but its taxonomic position is nevertheless in little doubt. Indeed, the essentially unmodified forewing venation (as preserved), with complete 2r-rs and proclival basal abscissa of RS clearly indicates Symphyta, whilst the very long and narrow (needle-like) ovipositor combined with the simple RS and small basal flagellomere permits the exclusion of all lower Hymenoptera except for Siricoidea and trematothoracine Sepulcidae (Cephidoidea). It is unlikely to be a member of the Siricoidea since Gigasiricidae have the third flagellomere long and thick, Siricidae have the basal abscissa of RS either vertical or reclivit, while in both Anaxyelidae and Xiphydriidae M+Cu is straight or nearly so, and the costal space usually bears a crossvein-like remnant of SC. Within Sepulcidae, the long, narrow ovipositor combined with the small basal flagellomere indicates Trematothoracinae, while R complete within 3r cell, single r-m crossvein, and M+Cu arching basally are all characteristic of *Prosyntexis*.

Family Gasteruptiidae ASHMEAD 1900

(KIRBY 1837)

Subfamily Baissinae RASNITSYN 1975

Genus *Manlaya* RASNITSYN 1980

Manlaya lacabrua n. sp.

Fig. 2

1991 *Manlaya* n. sp. – ANSORGE: 60, fig. 54; pl. 7, figs. 4–5.

Derivatio nominis: named after the locality (La Cabrua outcrop).

Holotype: female, part and counterpart, housed in Institut für Geologische Wissenschaften of Ernst-Moritz-Arndt-Universität Greifswald, FGWG 147 (MA 15).

Diagnosis: In its small size the new species is comparable only to *M. oculatissima* RASNITSYN & JARZEMBOWSKI (1998) from the Berriasian Purbeck Limestone Group of England, but differs in having smaller eyes, RS base close to pterostigma, and cells 2rm and 1mcu more distant.

Description: Male unknown. Female: ground colour dark; femora lighter, trochanters, tibiae and tarsi light; flagellum light, darkening toward apex; pterostigma dark except basally; sheath moderately light. Flagellum thin, with 12 segments, flagellomeres 1.5–2.5 times as long as wide except subquadrate penultimate one. Eyes moderately large; temples relatively wide. Propodeum rugose

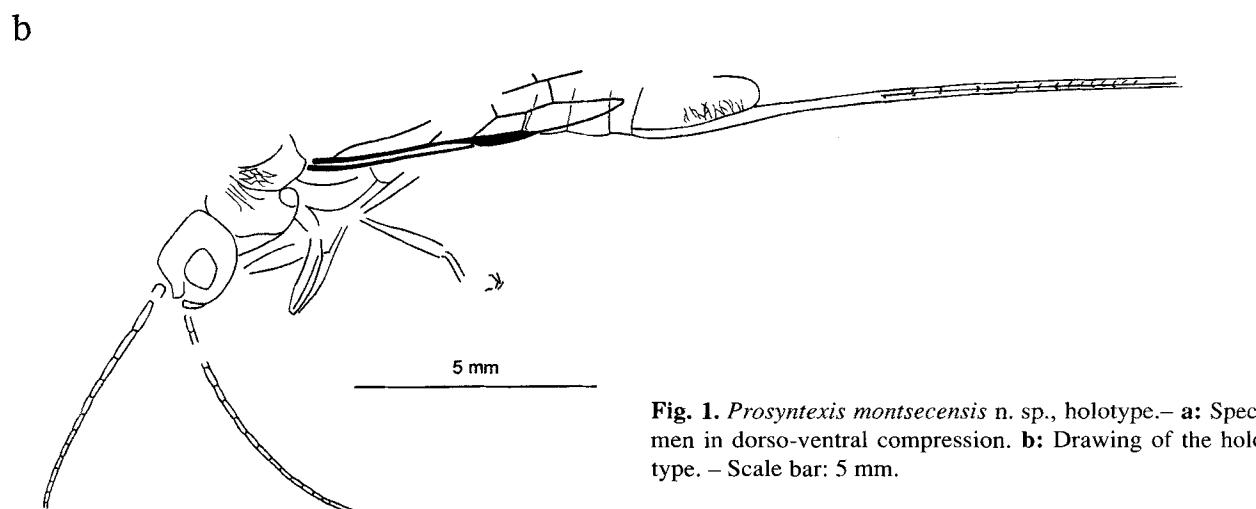
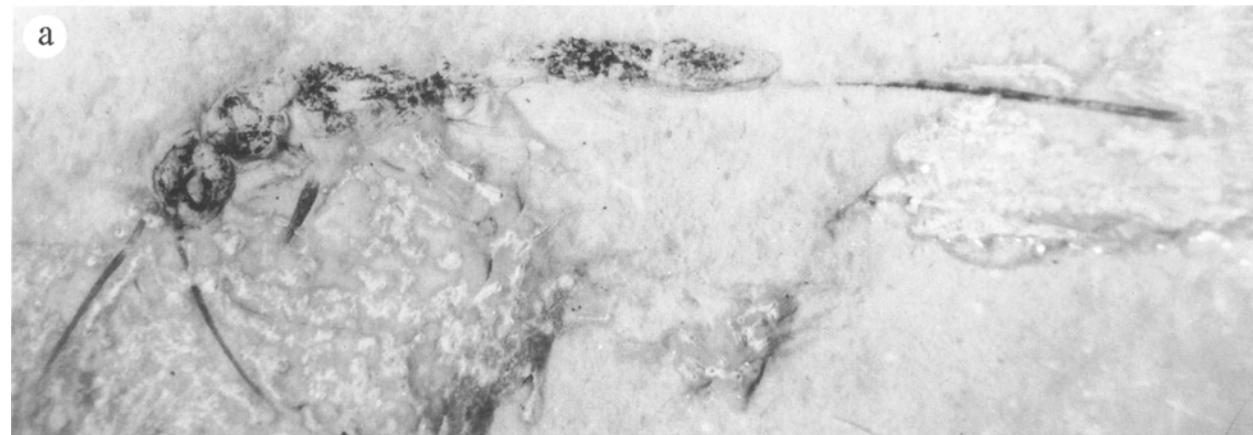


Fig. 1. *Prosyntexis montsecensis* n. sp., holotype. – a: Specimen in dorso-ventral compression. b: Drawing of the holotype. – Scale bar: 5 mm.

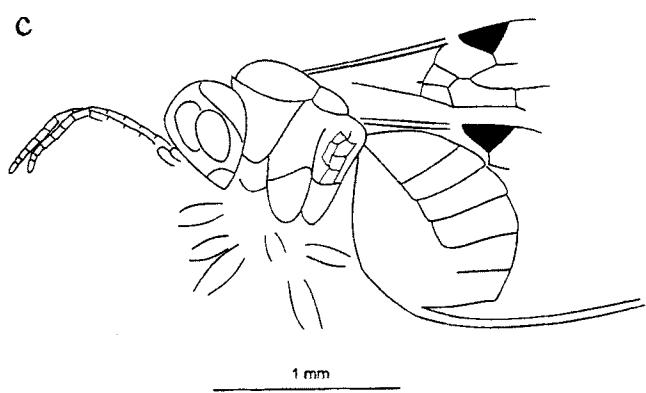
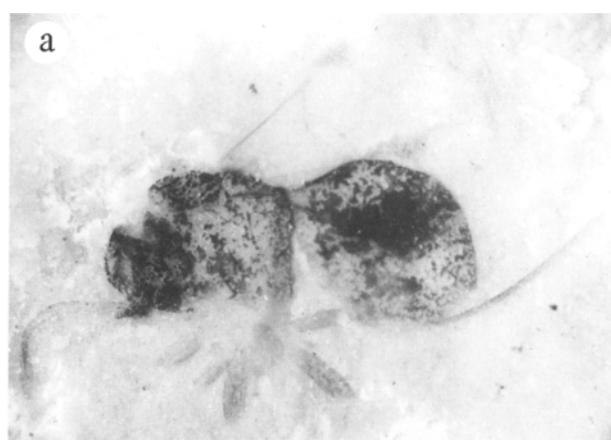


Fig. 2. *Manlaya lacabrua* n. sp., holotype. – a-b: Part and counterpart of a lateral compression. c. Drawing of the holotype. – Scale bar: 5 mm.

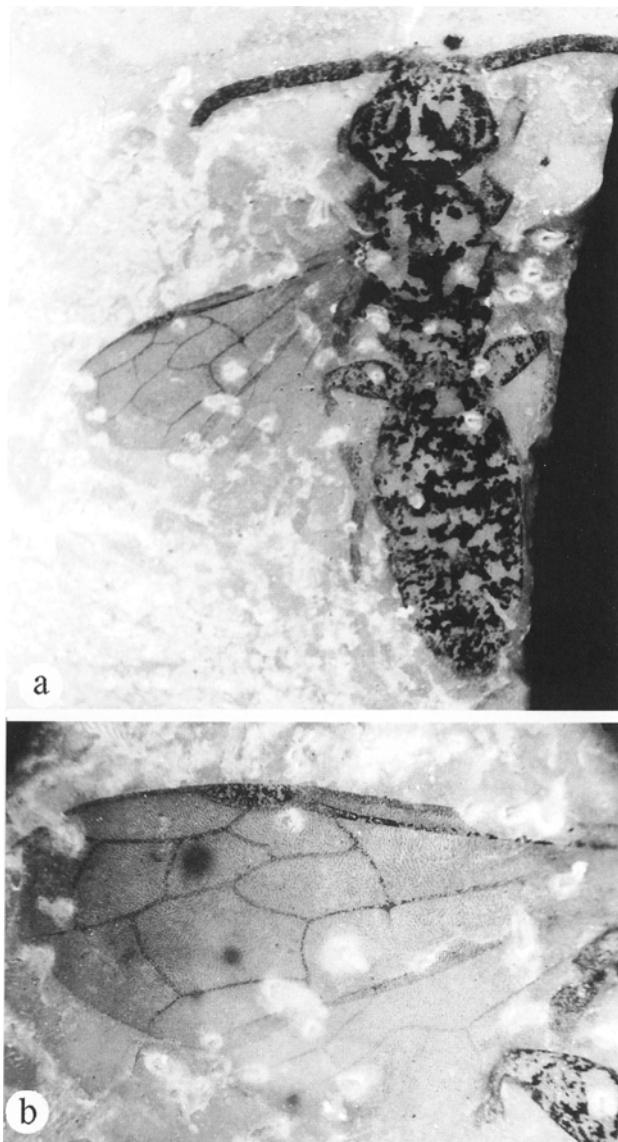


Fig. 3. *Meiagaster cretaceus* n. gen., n. sp., holotype. — **a:** Specimen in dorso-ventral compression. **b:** Fore- and hindwing. **c:** Drawing of the holotype. — Scale bar: 5 mm.

laterally. Forewing with RS base near pterostigma; 2r-rs near pterostigma midlength, less than half as long as pterostigmal height; cells 2rm and 1mcu separated by almost 1m-cu length; M+Cu possibly reduced except near its fork, cu-a barely extending beyond that fork; 2m-cu distinct. Femora rather thick. Ovipositor sheath more than half the length of forewing. Length of body 2.0 mm, forewing up to pterostigmal apex 1.1 mm (up to 3r cell apex probably 1.6–1.8 mm), ovipositor sheath not less than 1.2 mm.

Family Bethylonymidae RASNITSYN 1975
Genus *Meiagaster* n. gen.

Typus generis: *Meiagaster cretaceus* n. sp.

Derivatio nominis: Meia is a local topographic name.

Diagnosis: The new genus resembles *Bethylonymus* RASNITSYN 1975 in its complete venation (except for loss of free apex of Cu in hind wing) but differs in having

clypeus much protruding, notauli more convergent backwards, forewing cells 2rm and 1mcu widely overlapping, and hindwing RS with long basal abscissa. Antenna 11-segmented.

***Meiagaster cretaceus* n. gen., n. sp.**
Fig. 3

- 1991 Sapyginae gen. indet. sp. nov. — ANSORGE: 64, fig. 58–59; pl. 8, figs. 1–2.
1993 undetermined sphecid — ANSORGE 1993b: 33, fig. 4.

Derivatio nominis: after the Cretaceous Period.

Holotype: male, housed in Institut für Geologische Wissenschaften of Ernst-Moritz-Arndt-Universität Greifswald, FGWG 147 (MA 22).

Diagnosis: as for genus.

Description: Female unknown. Male: dark colour. Antenna short, uniformly thick, with scape and basal

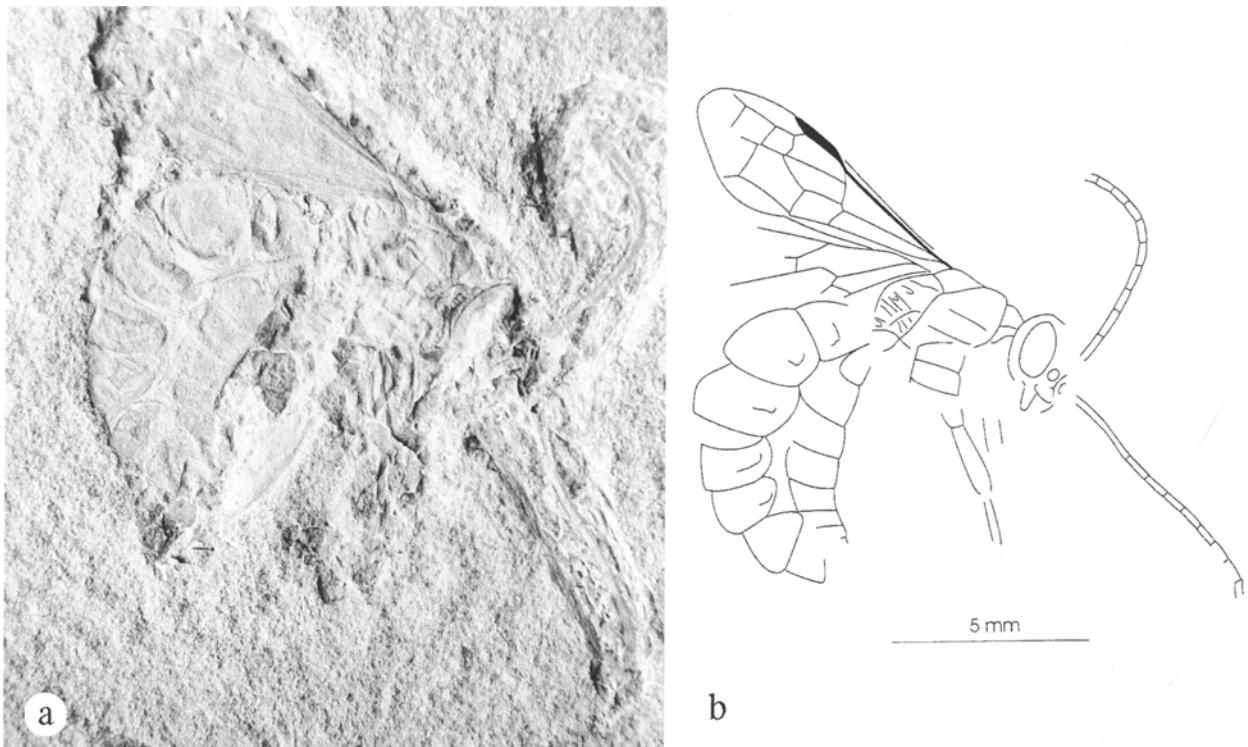


Fig. 4. *Angarosphex lithographicus* n. sp., holotype. – **a:** Specimen in lateral compression. **b:** Drawing of the holotype. – Scale bar: 5 mm.

flagellomeres less than twice as long as wide; pedicell short and ring-like; penultimate flagellomere near quadrate. Head wide, with large eyes; clypeus prominent, temples short, and ocelli arranged in a rather low triangle. Forewing with short, rather thick pterostigma, receiving short 2r-rs beyond its midlength; RS between RS+M and 2r-rs smoothly arching, without rudiment of 1r-rs; cell 2rm receiving 1m-cu and 3rm receiving 2m-cu before their midlength; cu-a barely extending beyond M+Cu fork. Hindwing with r-m separated from RS base by over twice its length; cu-a vertical. Legs short; femora thick, particularly so subbasally; hind femur with near-straight ventral contour and strongly convex dorsal surface; hind tibia not thick, 1.4 times as long as hind femur; hind basitarsus half as long as hind tibia. Metasoma long and thick, with terga gradually becoming shorter caudally. Genital claspers setose at least apically. Length of body 9.7 mm, of forewing 5.2 mm.

Family Sphecidae LATREILLE 1802
Subfamily Angarospheciniae RASNITSYN 1975
 (= *Angarosphecidæ* RASNITSYN 1975 = *Baissodidae* RASNITSYN 1975)

The composition and taxonomic state of the paraphyletic subfamily *Angarospheciniae* are discussed by RASNITSYN et al. (1998), as are the reasons for the above synonymy.

Genus *Angarosphex* RASNITSYN 1975

***Angarosphex lithographicus* n. sp.**

Fig. 4

1991 ?*Archispheci* n. sp. – ANSORGE: 61, figs. 55 – 56; pl. 7, fig. 2.

Derivatio nominis: after the source deposit, the lithographic limestone.

Holotype: male, housed in Institut für Geologische Wissenschaften of Ernst-Moritz-Arndt-Universität Greifswald, FGWG 147 (MA 7).

Diagnosis: In the key to *Angarosphex* in RASNITSYN et al. (1998) the new species runs to *A. bleachii* RASNITSYN & JARZEMBOWSKI (1998), but differs in its small size and short cell 2rm.

Description: Female unknown. Male (because of 7 visible metasomal terga and 8 sterna): colour light throughout. Antenna inserted slightly above upper clypeal margin. Flagellomeres thin, about 2.5–4 times as long as wide, becoming shorter toward apex; scape probably short. Eye large, leaving malar space short; temple relatively narrow; clypeus small, with apical margin slightly arching; interantennal space with longitudinal ridge; mandible apparently small. Pronotum moderately short; propodeal sides of metapleuron horizontally rugose or ridged, otherwise thoracic morphology obscure. Forewing with narrow and parallel-sided

pterostigma, receiving 2r-rs subapically; 2r-rs almost as long as pterostigma is wide; 3r cell acuminate at wing fore-margin; RS close to pterostigma basally, subvertical between cells 1+2r and 2rm, with no sign of 1r-rs rudiment; 2r-m and 3r-m straight, subvertical, 2rm cell small, only slightly wider than high, receiving 1m-cu in its base, 3rm cell much wider than 2rm, receiving 2m-cu near its base; cu-a well before M+Cu fork. Hind wing with cu-a meeting Cu at a distance from M+Cu of about 0.4 times cu-a length. Metasoma not petiolate, with no disproportionately large segments, and with anterior terga with sublateral humps. Body length as preserved (with metasoma distended due to postmortem effects) 12 mm, forewing length 7.7 mm.

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